

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
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SRM Number: 3129a
MSDS Number: 3129a
SRM Name: Lithium Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of lithium. One unit of SRM 3129a consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of lithium. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Lithium Standard Solution

Other Designations:

Lithium: Li; lithium metal; lithium, elemental.

Lithium Nitrate: Nitric acid, lithium salt.

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	1
Lithium Nitrate	7790-69-4	232-218-9	9.93
Lithium	7439-93-2	231-102-5	1.0

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. At normal occupational exposure levels, lithium and lithium compounds can irritate the respiratory tract, skin, and eyes; higher doses can cause GI upset and may damage the kidneys, central nervous system, and other organs. Ingestion of inorganic nitrates may cause severe illness or death.

Physical Hazards: Glass container may break or shatter.

Potential Health Effects

Inhalation:	Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Lithium nitrate can irritate the mucous membranes and interfere with breathing; at high levels, inhalation can cause symptoms described for ingestion. Inhalation of lithium dust can cause burns, mouth ulcers, pulmonary edema, or death in severe cases.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Contact with lithium and lithium nitrate can also cause skin irritation and burns. Lithium is poorly absorbed through the skin.
Eye Contact:	Both nitric acid and lithium can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Lithium nitrate can cause eye irritation.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Ingestion of lithium or lithium nitrate can cause pain, nausea, vomiting, and diarrhea; a large dose can burn or perforate the esophagus and stomach, and may also affect the central nervous system and kidneys. Symptoms may include blurred vision, drowsiness, weakness, tremor, and shock. Like other nitrates, lithium nitrate can also cause methemoglobinemia (an abnormal condition of the blood), with cyanosis, convulsions, and breathing difficulty.

Medical Conditions Aggravated by Exposure: This SRM and its three components may aggravate disorders affecting the eyes, skin, central nervous system, GI tract, kidneys, or respiratory tract. One component, lithium, can aggravate a number of medical conditions including diabetes, hypothyroidism, and psoriasis. People who consume large amounts of caffeine or sodium, and those who take medications containing lithium, may be more vulnerable than others to the effects of workplace exposure to lithium. Pregnant women should avoid contact with lithium because it crosses the placental barrier.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified medical personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO_2). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: No data are available for this mixture. Nitric acid does not burn, but it is a powerful oxidizing agent that can react with combustible materials to cause fires. Lithium nitrate is also a strong oxidizer that may ignite on contact with combustible materials. When lithium burns, the flame may be crimson or white at higher temperatures.

Extinguishing Media: Lithium fires in general should be extinguished only with chemicals designated for that purpose, since lithium is toxic to the central nervous system. If only small quantities of this SRM are involved, firefighters may use media appropriate to the surrounding fire (water spray, dry chemical, carbon dioxide, or foam). Water spray can be used to dilute nitric acid and to absorb liberated oxides of nitrogen.

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): For lithium metal (not for this mixture), autoignition temperature is 179°C (354°F).

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

Products of Combustion: Thermal decomposition of this mixture can produce nitrogen oxides, hydrogen compounds, lithium oxide, and other toxic or irritating gases.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m³
OSHA TLV-TWA: 2 ppm or 5 mg/m³

Lithium and Lithium Nitrate:

ACGIH TLV-TWA: None established.
OSHA TLV-TWA: None established.

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Lithium Nitrate	Lithium
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Colorless, deliquescent crystals, granules, or powder.	Appearance and Odor: A silvery-white solid that changes color on exposure to moist air; odorless.
Relative Molecular Weight: 63.02	Relative Molecular Weight: 68.95	Relative Molecular Weight: 6.941
Molecular Formula: HNO ₃	Molecular Formula: LiNO ₃	Molecular Formula: Li
Specific Gravity: 1.0543 (10%)	Specific Gravity: 2.38	Specific Gravity: 0.534
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in alcohol, pyridines, and ammonium hydroxide	Solvent Solubility: Soluble in liquid ammonia, acids, and alcohol
Water Solubility: Soluble	Water Solubility: 89.8% soluble @ 28°C (82°F)	Water Solubility: Lithium reacts violently with water, forming hydrogen and lithium compounds.
Boiling Point: 86 (187°F)	Boiling Point: 600 (1112°F); decomposes	Boiling Point: 1342 (2448°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): N/A	Vapor Pressure (Pa): 133 @ 723°C (1333°F)
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): 2.4	Vapor Density (Air=1): N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of lithium and nitric acid. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Contact with moisture, combustible materials, or incompatible materials; dust generation.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Lithium Nitrate: Incompatible with acids, combustible materials, metal salts, and reducing agents.

Lithium: Incompatible with numerous materials including acids, combustible materials, acetonitrile, metals, metal salts, reducing agents, halogens, halocarbons, metal carbides, and metal oxides.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of this mixture can produce nitrogen oxides, hydrogen compounds, lithium oxide, and other toxic or irritating gases.

Hazardous Polymerization: ☐ Will Occur ☒ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: ☒ Inhalation ☒ Skin ☒ Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Lithium Nitrate: The toxicity of this compound has not been fully evaluated. No relevant data were found.

Lithium:

Rabbit, subcutaneous: LD_{Lo} = 4000 mg/kg

Mouse, intraperitoneal: LD₅₀ = 1 g/kg

Dog, intravenous: LD_{Lo} = 325 mg/kg

Target Organ(s): Respiratory tract, eyes, skin, GI tract, kidneys, liver, blood, thyroid, central nervous system.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has been investigated as a possible mutagen. Lithium can induce birth defects in mice, but only at extremely high doses that humans would not normally encounter. Some studies suggest that lithium is associated with a slight risk of fetal heart defects in humans. Lithium may also reduce sperm motility in humans.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L

Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Lithium Nitrate: The toxicity of this material has not been evaluated. No relevant environmental data were found.

Lithium: The toxicity of this material has not been fully evaluated. No relevant environmental data were found.

Environmental Summary: Limited information is available regarding the ecotoxicity or environmental fate of this mixture or some of its components. Do not flush or release to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture is a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Nitric Acid Solution, Hazard Class 8, UN2031, Packing Group II

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Lithium and Lithium Nitrate: Not regulated

SARA Title III Section 302: Nitric acid is regulated

SARA Title III Section 304: Nitric acid is regulated

SARA Title III Section 313: Nitric acid is regulated; lithium nitrate is regulated as N511, Nitrate Compounds.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations ($\geq 94.5\%$) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

STATE REGULATIONS

California Proposition 65: None of the components are regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Lithium Nitrate: C (oxidizing material), D2A (toxic material)

Lithium: D2A (toxic material).

WHMIS Ingredient Disclosure List:

Nitric Acid: Regulated.

Lithium and Lithium Nitrate: Not regulated.

CEPA Domestic Substances List (DSL): All three components are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Lithium Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Lithium: F (Flammable), C (Corrosive)

Risk Phrases (mixture):

R23 (toxic by inhalation)
R25 (toxic if swallowed)
R34 (causes burns)
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

16. OTHER INFORMATION

Sources:

Hazardous Substances Data Bank (HSDB): Lithium and Lithium Compounds.

Intergovernmental Forum on Chemical Safety, Forum IV: Chemical Safety in a Vulnerable World. November 2003.

International Programme on Chemical Safety (IPCS), International Chemical Safety Card: Lithium.

Lagerkvist BJ, Lindell B, Lithium and lithium compounds. *Arbete Och Hälsa* 2002:16.

PAN Pesticide Database: Nitric Acid.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.